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Rootrot of Peas

Some ways
to avoid it

EXTENSION SERVICE OF THE COLLEGE OF AGRICULTURE
THE UNIVERSITY OF WISCONSIN, MADISON

THIRTY canning companies in Wisconsin provided funds in 1924 for a disease survey of a part of their territory to determine to what extent rootrot occurred, and to assemble field experience which might indicate the rotation or other field practice which will eliminate or reduce injury from this disease.

The survey covered 688 fields including 5,416 acres. Of these, one-third contained the disease in greater or smaller amounts. The survey must be continued for two or three years before final recommendations for rotation can be made. The one season's work has clearly demonstrated the importance of rootrot and has provided much other information of value to growers of peas.

The material in this circular is based on records obtained in the 1924 survey, supplemented by experience with this disease accumulated at the Wisconsin Experiment Station during the past fourteen years.

Rootrot of Peas

M. B. LINFORD AND R. E. VAUGHAN

PEA ROOTROT causes greater losses to Wisconsin pea growers at the present time than all other pea diseases combined.

Several other diseases assume importance under special conditions, and at times may become more destructive locally than rootrot. Still, considering the state as a whole, they are comparatively of minor importance.

What Rootrot Is and Does

Rootrot is caused by a parasitic fungus¹ which lives in the soil and is spread by any agency that carries soil from one field to another. This fungus causes a rotting of the roots and the base of the stem under ground. Diseased roots become soft, somewhat yellowish, and frequently watersoaked in appearance. Later they gradually darken and shrivel and the outer layers rot off into the soil until only the slender central core of the root remains. Roots thus damaged not only are unable to function normally but are prevented from making further growth.

The consequent effect upon the upper part of the plant or "vines" depends upon their age when the rootrot occurs. If the disease is far advanced when the plants are half grown or younger, they will tend to lose their healthy color, slowly shrivel and die. A later attack may cause reduced vigor and failure to fill pods. Thus rootrot may cause injury ranging in amount from that which is so slight that it may escape notice to complete destruction of the crop.

Both the amount of rotting of the roots and the rate of resulting stunting and shriveling of the vines are influenced greatly by weather and by soil conditions. The worst damage results when a period of warm moist weather, which stimulates the root rotting, is followed by a few bright hot days with drying winds which

¹This fungus (a newly described species of *Aphanomyces*) is especially destructive of peas and is apparently the commonest cause of pea rootrot not only in Wisconsin but in other canning sections of the United States.



FIG. 1.—PEA ROOTROT SURVEY

Rootrot commonly occurs first in small patches from which it spreads throughout the field.

quickly shrivel the vines. It follows that the date of planting is an important matter influencing the amount of rootrot injury. Early planted peas usually are farther advanced before the soil becomes warm enough to allow the disease to begin and, therefore, suffer less than the late planted crop.

Crop Rotation Is Important

That rootrot occurs most frequently where peas have been grown several times in succession or in short rotation is generally agreed. There is, however, much difference of opinion in different localities regarding the length of time that peas may be grown in succession on the same ground without loss from this disease. Instances are reported of peas having been grown many years on the same field without any injury from rootrot. No cases of this kind were observed in the 1924 survey. In fact, only three fields having a fourth successive crop of peas were free from rootrot.

The rate at which rootrot begins to appear in fields with succeeding crops of peas, disregarding the rotation practiced, is shown in figure 3. Rarely was a trace of rootrot found in fields grow-

ing their first crop of peas, and in these instances infection could usually be traced to nearby diseased fields. Over half of the fields growing the third crop of peas showed at least a trace of disease, while disease was found in every field which was growing its fifth crop of peas.

Rootrot Increases Yearly

The estimates of loss from this disease show that the heavier losses from rootrot occurred in those fields in which 75 to 100 per cent of the plants were found diseased. These fields are called severely infested and are shown graphically in figure 4. Disregarding the intervals, which on the average were short, that may have elapsed between these crops, it is clear that the percentage of severely diseased fields is not large and does not increase rapidly up to the fifth crop of peas. Here there is a sudden increase in the severity of disease. Only 17 per cent of all fields which were growing their fourth crop of peas were severely diseased, while 56 per cent of all fields growing the fifth crop suffered heavy loss from rootrot and every one of them was more or less diseased. More than three-quarters of all fields bearing their sixth crop of peas were thoroughly infested by rootrot.

Crop Rotation Delays Rootrot

More pea crops can be grown in rotation than in succession before rootrot becomes destructive. This statement is supported by instances observed in the 1924 survey where a three-year rotation had delayed but not entirely prevented the entry of the disease. Records of longer rotations are too incomplete to be of value. It is expected, however, that similar field study carried on during the next two years will accumulate enough field experience to show clearly whether a long rotation can be depended upon to prevent serious rootrot indefinitely.

Whatever future surveys may show, however, this much can be said at present: any field severely infested with rootrot is a source of infestation to neighboring fields or farms, and thus hastens the appearance of severe rootrot and reduces the number of profitable crops in all the surrounding area. The use of a rotation, even a short one, delays the appearance of these cen-

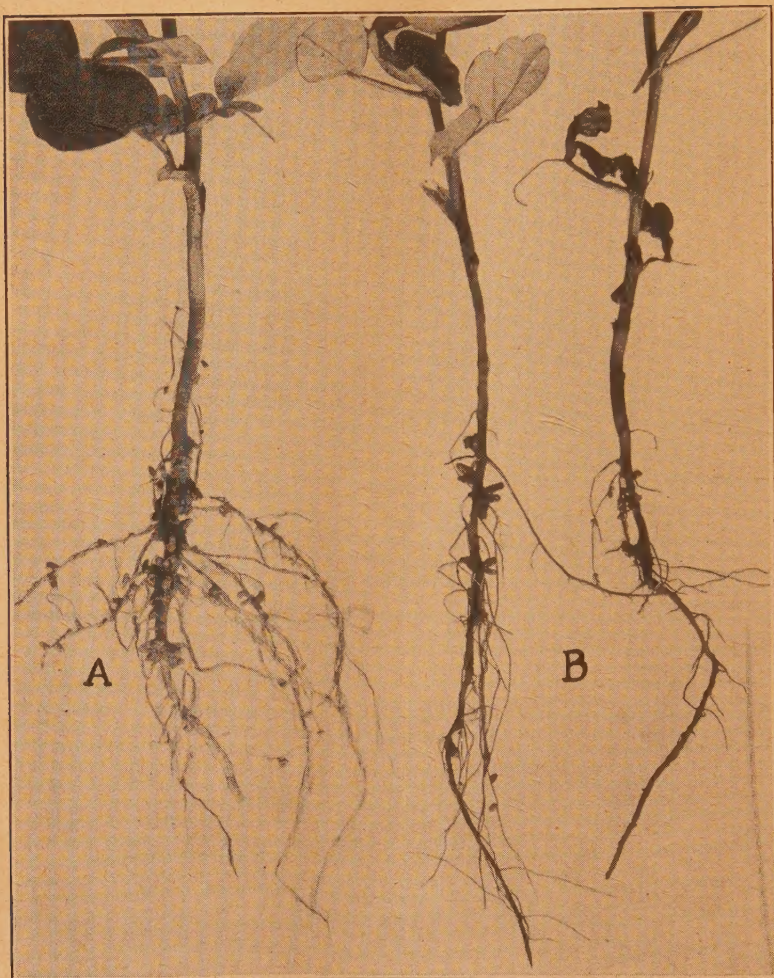


FIG. 2.—HEALTHY PLANT (A) IN CONTRAST WITH PLANTS DAMAGED BY ROOTROT (B).

Roots of diseased plants, and stem to just above the surface of the soil, are softened, darkened and shriveled. Stem, roots and nodules of the healthy plant are plump and white. Severe root injury has caused the death of the leaves of the plant at the right. (Photograph courtesy of U. S. Department of Agriculture.)

ters, and thus delays the ruin of surrounding fields for pea growing. This indirect advantage of even a short rotation is great enough to make it highly profitable.

Rootrot Persists In Soil

Of 15 fields of peas examined in 1924 growing where the last previous crop of peas had been damaged from rootrot within ten years, all were found to contain the disease. Of nine fields which were growing peas at an interval of 10 or more years after the previous crop had suffered from rootrot, three showed a high degree of infestation, and five showed no trace of disease. Thus it appears that ridding a soil of the rootrot fungus is a very slow process indeed.

Main Points In Rootrot Control

Much pea growing must be done in districts where rootrot is more or less thoroughly scattered, not only from the growing of canning peas, but from cropping with field or seed peas before the canning industry developed. Here the avoidance of loss from rootrot is not always an easy matter.

In such territory two methods of avoiding trouble are of value. First, do not plant peas on fields which have a previous record of a crop failure. Second, inspect all fields carefully for the beginning of rootrot.

Rootrot usually appears first in small spots in fields and spreads from these for about two years before it is abundant enough to cause important crop reduction (see figs. 3 and 4). Although 40 per cent of the fields producing their second crop of peas and 55 per cent of the fields producing their third crop of peas show at least traces of rootrot, few of these fields have a large amount of disease. Only in the fifth year of pea growing does severe injury occur in 56 per cent of the fields. This clearly means that most cases of severe injury were preceded by two years when the disease was present, but in so small an amount that it did no great amount of damage. If the disease had been recognized as present in either of the preceding years; and further planting of peas had been stopped, large losses could have been avoided.

Rootrot and Soil Type

Occasional fields are found severely diseased with the first or second crop of peas. These are generally due to infection from nearby diseased fields or to peculiar soil and drainage conditions. In spite of such exceptions, one of the most profitable means of avoiding losses is to examine pea fields for the beginning of rootrot and then not to plant peas in fields known to be diseased.

The survey made special study of the relation of soil type variety of soils ranging from light sand to heavy clay. In general it appears that rootrot enters fields on the heavy soils more promptly and injures plants more severely than on the medium or light soils. Little or no difference was found, however, between the two or three common soils upon which the large majority of pea fields are located.

The rootrot fungus is favored by an abundance of water in the soil, and consequently it usually appears first in heavy soil which holds water well, or in poorly drained places in lighter soils. From such beginnings it spreads rapidly to the rest of the field. Probably a longer period of rotation will be required to avoid disease on clays and clay loams than on medium or light well drained soils. Once established, the rootrot fungus is remarkably persistent in any type of soil.

Rootrot and Varieties of Peas

No variety of canning pea is immune to rootrot. The following varieties and several others were examined in 1924 and found to have the disease: Alaska, Winner, Green Admiral, Perfection, Horsford, and Advancer. The first three were slightly less affected than the last three, but the differences may have been due to local or seasonal conditions. On experimental grounds at Columbus, Wisconsin, where Alaska and Horsford were complete failures the new Horal pea developed by E. J. Delwiche, Wisconsin Experiment Station, and Rice's No. 330, recently introduced by the J. B. Rice Seed Company, showed considerable resistance. If these new varieties are adapted to the needs of canners and continue to show a high degree of resistance in future trials, they can undoubtedly be used to great advantage, especially on land which is only slightly infested with disease.

Other Pea Diseases

A type of wilt disease was located for the first time this year in Fond du Lac and nearby counties. It occurred mostly on the black types of soil and was characterized by more rapid death of the plants than in the true rootrot, without a distinct decay of the root system. In a few cases it was more injurious than rootrot.

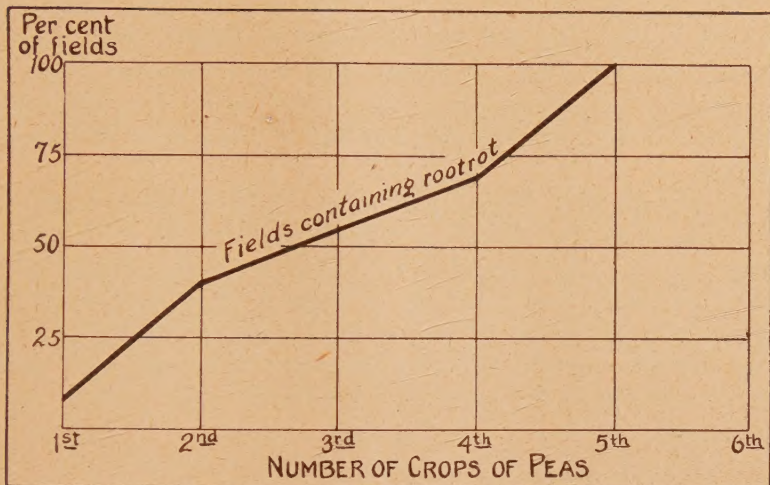


FIG. 3.—MORE PEAS, MORE ROOTROT

Graph showing the increase in percentage of fields which contain rootrot in greater or lesser amount in relation to the number of crops of peas grown.

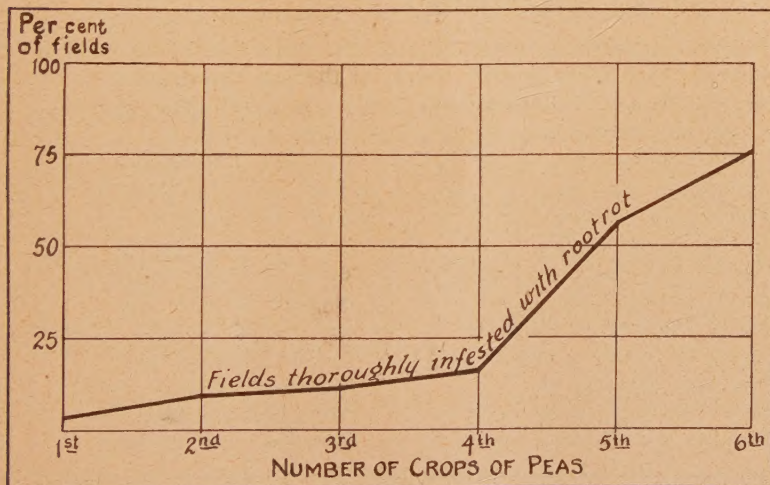


FIG. 4.—PEA ROOTROT INCREASES IN DESTRUCTIVENESS AFTER THE FOURTH CROP

Graph showing the percentage of fields thoroughly infested with rootrot in relation to the number of crops of peas grown.

Comparison of this figure with figure 3 indicates that fields generally contain rootrot for one or two years before it becomes destructive.

The leaf or pod spot disease which in past seasons has occurred destructively and been discussed as "blight" was almost totally absent in 1924. It appears that the dry weather in early summer of the past two years has provided such unfavorable conditions for its spread in the field that it has practically disappeared.

In contrast with "blight", anthracnose, which is another type of leaf and stem spot disease, previously regarded as of rare occurrence, was found destructive in a few localities. Downy mildew, leaf blotch and a number of other diseases were recorded more or less frequently but seemed to be of minor importance. For the present, rootrot is by far the most widespread and destructive disease of the pea crop in Wisconsin.

The 1924 pea rootrot survey was made possible by subscriptions from the following canning companies:

Badger Canning Co.	Onalaska Canning & Pickle Co.
Bloomer Farm Prod. Co.	Oostburg Canning Co.
Central Wisconsin Canneries	Plymouth Canning Co.
Columbus Canning Co.	Ripon Canning Co.
Dutch Canning Co.	Rockfield Canning Co.
Fox Valley Canning Co.	Rock River Canning Co.
Fuhremann Canning Co.	Sauk City Canning Co.
Galesville Canning Co.	Saukville Canning Co.
Garden Canning Co.	Silver Creek Canning Co.
Gillett Canning Co.	Stevens Canning Co.
Hussa Canning & Pickle Co.	Theresa Canning Co.
Mammoth Spring Canning Co.	Waldo Canning Co.
Medford Canning Co.	Waterloo Canning Ass'n.
New Holstein Canning Co.	Waunakee Canning Co.
Oconomowoc Canning Co.	Waupun Canning Co.

Diseases of Peas in Wisconsin

Rootrot—(Aphanomyces) Soft decay of outer part of roots and base of stem; watersoaked at first; later dark and shriveled. (See fig. 2.)

Wilt—(cause unknown) Plants wither and die more quickly than with rootrot. No conspicuous decay of roots.

Stem and Rootrot—(Fusarium) Dark brown rot near attachment of seed. May cause reddish discoloration of core in stem base in hot weather. Occurs chiefly with rootrot.

Footrot—(Phoma) Not easily distinguished from the preceding. Occurs usually on scattered plants.

Seedling Blight—(Pythium and Rhizoctonia) Kills growing tips of roots and shoots of germinating peas, causing thin stands. More serious in late plantings.

Anthraxnose—(Colletotrichum) Brown spots with dark borders; round on pods, irregular on leaves, elongate on stems. Bronzing of stems. Old spots thickly covered with fine black specks.

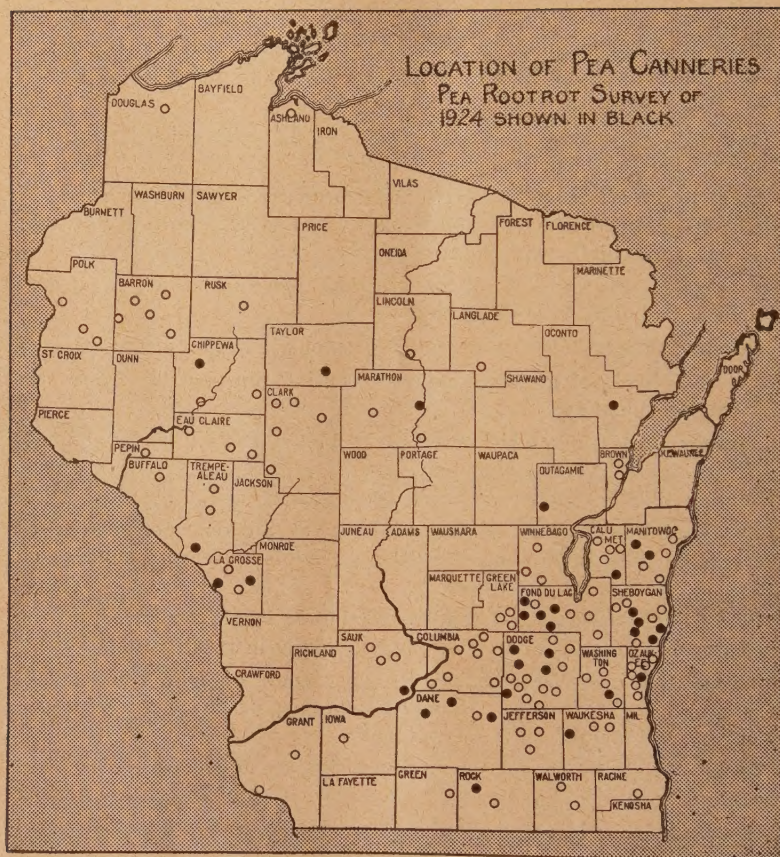
Leaf and Pod Spot or Blight—(Ascochyta) Sunken spots with dark margins on pods; may penetrate to seed. Spots on leaves rounded; on stems elongate.

Leaf Blotch—(Septoria) Irregular blotches on leaves; yellowish brown. Often occurs on pods and stem. Found chiefly in northern districts.

Bacterial Blight—Watersoaked irregular spots on leaves and stems, becoming brown with age. Rounded sunken spots on pods. Most frequent in peas planted early on wet soil.

Downy Mildew—(Peronospora) Purplish gray downy patches on underside of lower leaves. Leaves turn yellow. Chiefly in early spring.

Mosaic—Upper leaves mottled light and dark green. Plants become pale. Widespread. Unimportant at present.



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